The Impact of a one day Undergraduate Radiology Course on Confidence and Performance of Medical Students in Interpreting commonly encountered Radiographs


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Abstract

Introduction

Research into undergraduate radiology teaching suggests that medical students feel their radiology training is currently inadequate. Radiology, as a specialty, is generally not taught formally at medical school; rather, it is integrated inconsistently into various other specialties. This study aimed to investigate whether a one day course could help medical students with both confidence and performance.

Methods

Participants consisted of third and fourth year medical students from Barts and The London School of Medicine and Dentistry. The course consisted of morning lectures delivered by radiology registrars and afternoon small group interactive tutorials led by foundation doctors. The topics were chest (CXR), abdominal (AXR), musculoskeletal radiographs and computed-tomography (CT) of the head. The learning outcomes were created in accordance with the Royal College of Radiologists undergraduate curriculum. There was a pre and post course assessment consisting of 15 multiple-choice questions. Additionally a questionnaire was given evaluating their confidence in interpretation (rated from 1= not confident to 10=completely confident). A paired T-test was performed to investigate the significance of the results.

Results
7 students completed the quiz and questionnaires. The mean assessment scores were 10.43 pre-course and 14.33 post-course. This demonstrated a statistically significant improvement of 4.43 marks or 27% (p=0.0004 95% CI 2.59 to 5.41). Likewise, students demonstrated a significant increase in confidence in all four areas. Confidence in CXR interpretation increased by 21%, or 2.1 points (p=0.0113 95% CI 0.69 to 3.60); AXR increased by 31%, or 3.14 points (p=0.0008 95% CI 1.90 to 4.39); CT Head increased by 44%, or 4.43 points (p=0.0002 95% CI 3.03 to 5.83) and Musculoskeletal X-ray increased by 37%, or 3.71 points (p=0.002 95% CI 1.97 to 5.46).

Conclusion

Our results demonstrate that a one-day intensive course statistically raised both confidence and knowledge in interpreting common radiographs. The combination of lectures and interactive small group teaching sessions seemed to allow students to consolidate their knowledge and apply it more successfully when tested in the post-course assessment. Additional research is required to further explore the impact of the course and the plan is to run a second course at the start of the next academic year.

Keywords: Undergraduate, Radiology

Introduction

Undergraduate education in radiology is variable and inconsistent throughout UK based medical schools. It is unequivocal that medical students feel their teaching in this essential area of medicine is inadequate. Junior doctors report "unstructured" and "inadequate" undergraduate radiology teaching resulting in a feeling of unpreparedness prior to working.

Radiology is an ever increasing, evolving specialty, playing an essential role in the patient's journey through hospital. Despite this, there is no formal curriculum in UK medical schools that delivers such vital teaching, provided by radiologists. Instead, radiology is incorporated in the various specialties and thus an inconsistent level of exposure and quality of teaching is provided to medical students.

As a result, the Royal College of Radiologists (RCR) has set out the common conditions that foundation doctors should be competent at interpreting, published as the "Undergraduate Radiology Curriculum". This is particularly important for abdominal and chest radiographs, which in practice may not be reported for between hours to days, resulting in doctors who are not formally trained in radiology needing to interpret and thus form management plans based on imaging.

Throughout the academic year, we initially ran single radiology teaching sessions for final year medical students. The students felt unanimously that radiology teaching should have been given to them at an earlier stage and felt they would have benefited more from this. Thus, we created a nationally advertised course designed to tackle these misgivings aimed at medical students in their early clinical years (years 3 and 4).

The course aimed to expose students to the course material via lectures and small interactive group sessions. We also wanted to elucidate whether a single, one day course could help medical students with both their confidence at interpreting the basics in radiology as well as their attainment; qualified by a quiz.
Methods

The course was held on Saturday 29th April 2017 between 09:30 – 16:00. The course was structured into a morning lecture based session with all the students present and subsequently an afternoon session consisting of small grouped, round robin, interactive tutorials. The morning session was delivered by radiology registrars and aimed to give all the students an understanding of the basic principles required to interpret CT head, Chest, Abdominal and Skeletal radiographic images via the lecture based format. The afternoon session was delivered by the remaining tutors and was tailored to be clinically relevant for the students, highly intimate and interactive. In particular, the afternoon sessions consisted of 3 tutorials consisting of CT head and skeletal radiology cases, chest radiology cases and abdominal radiology cases. All sessions were 45 minutes in length. In total, 8 students attended the course: 5 third year medical students and 3 fourth year medical students. 7 tutors were drafted for the course.

Registrars were allocated the lecture based teaching sessions, whereas, all other tutors were allocated to 1 of 3 tutorials. Subsequently, all tutors were sent specific pre-course material for their allocated tutorial topic and general learning objectives 4 weeks prior to the course date. Material and learning objectives outlined what the tutors were expected to deliver from their tutorials, what format the tutorial should take and what the learning outcomes should be for the students.

Materials: for the lecture based teaching delivered by the registrars no material was created as this was left to the discretion of the registrars. For the tutorial based sessions, material was prepared in the form of a power point presentation with clinical scenarios and related radiology images being used that were commonly encountered by junior doctors in the clinical environment. The themes that were covered by the 3 tutorial sessions included 1) CT head and skeletal radiology, 2) Chest radiology and 3) Abdominal radiology.

Learning objectives

1. To understand the basic principles of image interpretation
2. To link the image to the clinical context provided
3. To practice implementing the basic interpretation principles
4. To practice presenting the interpretation findings
5. To formulate a working diagnosis based on the imaging findings
6. To construct an initial management plan

Data collection: Firstly, before the course commenced the students completed a spot diagnosis radiology quiz. At the end of the course the same quiz was repeated. Secondly, before and after the course we assessed, by means of a questionnaire, the confidence levels of the students with reference to interpreting CT head, Chest, Abdominal and Skeletal radiographic images. Finally, at the end of the course the students rated the content and delivery for each of the lectures and tutorials.

Results

As demonstrated by the feedback received in table 1, all aspects of our course were very well received both in terms of content and delivery.

<table>
<thead>
<tr>
<th>Sessions</th>
<th>Content</th>
<th>Delivery</th>
</tr>
</thead>
</table>

Results for the spot diagnosis quiz performed pre-course and post-course is demonstrated in table 2 and for the confidence changes in interpreting radiographs in table 3.

<table>
<thead>
<tr>
<th>Spot diagnosis quiz</th>
<th>Mean Score</th>
<th>Mean Improvement</th>
<th>Paired t test [95% Confidence intervals]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-course</td>
<td>10.43</td>
<td>4 points (27%)</td>
<td>p&lt;0.0004 [2.59; 5.41]</td>
</tr>
<tr>
<td>Post-course</td>
<td>14.43</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Spot diagnosis quiz, pre-course and post-course average scores out of 15 maximum.
Table 3: perceived confidence in interpretation ability split by modality, pre-course and post course mean scores. Confidence rating scale: 1=not confident; 10=extremely confident

<table>
<thead>
<tr>
<th>Modality</th>
<th>Pre-course</th>
<th>Post-course</th>
<th>Confidence Rating</th>
<th>p-value</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal Radiography</td>
<td>4.43</td>
<td>7.57</td>
<td>2.49 points</td>
<td>p&lt;0.0008</td>
<td>[1.90; 4.39]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(24.9%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skeletal radiography</td>
<td>3.29</td>
<td>7.00</td>
<td>3.71 points</td>
<td>p&lt;0.002</td>
<td>[1.97; 5.46]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(37.1%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CT head radiology</td>
<td>2.71</td>
<td>7.14</td>
<td>4.43 points</td>
<td>p&lt;0.0002</td>
<td>[3.03; 5.83]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(44.3%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Discussion

Throughout medical schools in the UK, formalised radiology teaching does not exist, a fact that is also echoed by many students.\(^1-3\) We feel that radiology teaching is lacking in the medical school curriculum for a number of prospective reasons. Firstly, in our opinion, there appears to be a limit to the direct input that radiologists have in the medical school curriculum. This results in less integration and thus less emphasis on specific radiology sessions. Secondly, most medical schools integrate radiology into the specialties thereby removing the need for radiology to be taught as its own entity. This may have a detrimental effect on both the confidence and the ability of junior doctors due to a lack of consistent quality of teaching.

The main aim of our teaching course was to attempt to bridge this gap in knowledge to facilitate (a) an increase in students' confidence at interpreting every day radiological images and (b) an increase in knowledge. We aimed to do this by combining both lectures and small group-interactive, case based teaching. The main advantage of interactive tutorials using case based scenarios is that clinical medicine is integrated with radiology. This enables the appreciation of both the medical or surgical issues alongside the necessity of radiology to establish diagnoses. This also enabled students to understand and appreciate the dynamics around the choice of radiological investigation and appropriate responses to the results. In addition, interactive learning in small groups has the purpose of engaging students into the material, providing an environment that both motivate students to learn as well as increasing their performance. Using traditional, didactic lectures alone has the risk of students becoming passive listeners rather than active learners,\(^8\) and thus we believe that the integration of the two modalities had considerable positive effects on the students. Formal lectures allow the sharing of baseline knowledge with small group tutorial improving recall of information, activation of prior knowledge, collaborative learning construction, cumulative reasoning and "cognitive conflicts leading to conceptual change".\(^9\)

Furthermore, near-peer-assisted learning (NPAL) is another technique implemented in this course. The tutors during the small group tutorials were all either foundation year 1 and 2 doctors and thus were only a couple years more senior than the students. NPAL is a rapidly expanding area of medical education with good evidence of its benefits and these tutors are thought to have a unique perspective and approach that is well received by student.\(^10\) We believe that the near-peer nature of this course was a significant factor in delivering the teaching successfully. Both confidence levels in interpretation of imaging and radiology quiz results had significantly increased after the course. However, with the relatively small numbers of participants, it is difficult to demonstrate that this will have true educational or clinical impact and so the results should be interpreted with caution.
With a number of the authors being current foundation doctors and thus having experienced undergraduate radiology teaching within the last 2 years, we are able to reflect on our experiences. In our opinion, undergraduate radiology teaching was relatively non-existent during medical school. There were a few ad hoc sessions but radiology was never formally included in our curriculum. The times that radiology was taught tended to be in specific student-led societies, upon popular demand, or as part of a rotation, commonly respiratory medicine. Although exposure to Radiology was present throughout rotations via ward rounds and multi-disciplinary meetings, devoted teaching sessions were lacking. Upon qualifying as doctors, the amount of imaging we came across and requested was overwhelming and we felt underprepared in interpretation.

It is not surprising that there is a current shortage of radiologists in the UK. Part of the reason for this may be the lack of radiology emphasis in the medical school curriculum. Our course reflects that medical students receive poor teaching, have poor radiology knowledge, and poor confidence when interpreting imaging. We believe a combination of lecture based and small group case tutorials can act as an apparatus to deliver radiology teaching. Integrating a course into the medical school curriculum may be an innovative method to help improve the highly variable and sometimes inadequate radiology teaching at medical school. Nevertheless, from personal reflection and experience we feel that increasing structured teaching in the curriculum and allocating dedicated placements will be the ultimate routes to improve medical student radiology teaching and awareness of the specialty.

**Conclusion**

The results of our course suggest a benefit to students both in knowledge and confidence in interpreting radiographical images of different modalities. This is likely, or at least in part, due to the combination of teaching methods with lectures and case based interactive sessions. Students have mentioned both anecdotally as well as in the literature that radiology teaching is lacking, which suggests that there is a large scope for improvement in the undergraduate curriculum (1-3, 5). We are planning to run this course on a yearly basis to ensure that radiology teaching continues to be provided at Princess Alexandra Hospital NHS trust and provide additional numbers for continued research.

**Take Home Messages**

**Notes On Contributors**

**Dr Vishnu Naidu**, Foundation Year 2 doctor; Contributed with organisation of the course and collecting data; Based at the Princess Alexandra Hospital NHS Trust, Harlow, UK.

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Appendices

Declarations

The author has declared that there are no conflicts of interest.

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